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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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09/915,396

07/27/2001

Atsumi Yamaguchi

211909US-2 CIP

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7590

03/26/2003

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EXAMINER

DEO, DUY VU NGUYEN

ART UNIT

PAPER NUMBER

1765

DATE MAILED: 03/26/2003

6

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/915,396

Applicant(s)

YAMAGUCHI ET AL.

Examiner

DuyVu n Deo

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 27 July 2001.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-18 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 14-18 is/are allowed.
- 6) ☒ Claim(s) 1-4 and 8-11 is/are rejected.
- 7) ☐ Claim(s) 5-7, 12 and 13 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 27 July 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 3, 4.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Specification

1. The lengthy specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

Drawings

2. Figures 48-53 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g).

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

4. Claims 1, 8 are rejected under 35 U.S.C. 102(e) as being anticipated by Oh et al. (US 6,200,903).

Oh describes a method for etching a semiconductor device comprising: forming an etching object, polysilicon layer, on the substrate; forming a resist film (claimed first resist film) on the etching object; patterning the resist film into a pattern; performing ion implantation at an

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tilted angle (claimed obliquely) into the resist pattern; etching the polysilicon layer using the resist film as a mask (col. 3, line 13-38; line 65-68). Since Oh performs the same process, ion implantation using Ar, which is the same as that of claimed invention. Therefore, his resist thickness would also be contracted by the ion implantation process as that of claimed invention.

Column 3, line 19 discloses a resist thickness of 650nm (or 6500 angstroms), which is between the resist thickness 585nm and 880 nm, disclosed in the pages 28 and 32 of specification. These resist thickness after the ion implantation step (or step d) is at the level that satisfies a condition that the difference in CD shift in work pattern with respect to the resist pattern between a dense pattern portion and a rough pattern portion in the work pattern is not more than a reference value and causes no hindrance to the etching. Also, column 4, line 21-34, describes by applying ion implantation, the thickness of the resist can be less by about 30-40% than for the conventional case to provide an easy photolithography process. Therefore, the thickness of the resist pattern described by Oh after the ion implantation step (or step d) would be at a level that reads on claimed resist thickness is set to a level satisfying a condition that the difference in CD shift in work pattern with respect to the resist pattern between a dense pattern portion and a rough pattern portion in the work pattern is not more than a reference value and causes no hindrance to the etching because he describes the same ion implantation step and his thickness is within the workable thickness as described by the specification.

5. Claim 1 is rejected under 35 U.S.C. 102(b) as being anticipated by Kobayashi (JP 4127518A).

Kobayashi describes a method etching a semiconductor device comprising: forming an etching object, poly layer, on the substrate; forming and patterning a resist on the poly layer; performing ion-implantation into the resist pattern, and therefore reducing the resist thickness; etching the poly layer to form a work pattern (pages 4-5 of the translation; fig. 1). The resist thickness is reduced from 0.6um (600nm) to 0.45 um (450 nm) (page 9, embodiment 2). This resist thickness level according to embodiments 5 and 8 after ion implantation (step d) is at the level satisfying such a condition that the difference in CD shift in the work pattern with respect to the first pattern caused between a dense pattern portion and a rough pattern portion in the work pattern is not more than a value and causes no hindrance to the etching.

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. Claims 2 and 3 are rejected under 35 U.S.C. 103(a) as being unpatentable over Oh as applied to claim 1 above, and further in view of applicant's admitted prior art.

Referring to claim 2, forming insulating film including silicon nitride is requisite in the conventional etching of the wiring pattern forming method as described in page 3, line 13 of specification. The silicon nitride (claimed ion prevention film) would further prevent ion implanted into the etching object since it covers the etching object.

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Referring to claim 3, forming the silicon nitride by plasma CVD is a technique that is well known to one skilled in the art at the time of the invention (please see cited Wolf et al. below).

8. Claims 2-4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Oh or Kobayashi as applied to claim 1 above, and further in view of Bell (US 5,767,018).

Referring to claims 2-4, using materials such as nitride, oxynitride, or organic ARC (claimed ion prevention films) is well known to one skill in the in fabricating of semiconductor process as anti-reflective coating (ARC) as shown here by Bell. They are deposited by CVD (col. 1, line 11-35, line 55-65; col. 7, line 41-49). It would have been obvious for one skill in the art at the time of the invention to modify Oh's method in view of Bell because Bell teaches that these materials would minimize notches caused by reflections during the photolithographic techniques (col. 1, line 24-26).

9. Claims 9, 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Oh as applied to claim 1 above, and further in view of Geusic et al. (US 6,518,615).

Unlike claimed invention, Oh doesn't describe the etching object (or polysilicon) has asperities on its surface. Geusic describes a method for forming memory cells where he teaches to the polysilicon has pores on its surface (claimed asperities on etching object surface) (col. 1, line 51-67). It would have been obvious for one skilled in the art to modify Oh in light of Geusic's teaching of having pores or asperities on the polysilicon surface because they both teach of forming capacitor (Oh: col. 4, line 50, 51; Geusic: col. 1, line 51-52) and the pores would increase the surface area in which it would increase the storage capacity of the capacitor (Geusic: col. 1, line 61-64; Oh: col. 4, line 50-51). Oh further describes impurities may be doped

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in the polysilicon layer (or etching object) before forming the photoresist (step b) (col. 3, line 16-17). And method for doping the polysilicon layer such as claimed ion implantation is well known to one skilled in the art (please see Wolf et al. cited below).

Referring to claim 10, techniques or steps of forming a pattern on the resist by performing exposure through a reticle and executing development are necessary steps that are well known to one skilled in the art of forming a resist pattern as shown here by Wolf (please see Wolf et al. cited below).

10. Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Oh and Geusic as applied to claim 9 above, and further in view of Borodovsky (US 4,529,685).

Referring to claim 11, above prior art doesn't describe the etching object has a mark for mask alignment on its surface. Borodovsky teaches a method of etching reflective surface such as polysilicon (or etching object) where he teaches the etching object has a mark for mask alignment on its surface (col. 1, lines 14-20, 55-57; col. 2, lines 10-15). It would have been obvious for one skilled in the art at the time of the invention to modify the method of above prior art in light of Borodovsky because he teaches that mark on the etching object would ensure the alignment of subsequent mask pattern placed thereon (col. 1, line 55-57; col. 2, line 10-15).

Allowable Subject Matter

11. Claims 5, 6, 12, 13 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claim 5 is allowable because applied prior art doesn't teach a step of ion implantation into the organic antireflection coating, which forms an ion prevention film.

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Claim 6 is allowable because applied prior art doesn't teach forming a second resist pattern on the etching object and etching the etching object using the 1st and 2nd resist pattern.

Claim 12 is allowable because applied prior art doesn't teach forming the third resist pattern, on the etching object, having opening on a mark forming region including the mark and performing ion implantation into the mark forming region of etching object using the third resist pattern as a mask.

Claim 13 is allowable because prior art doesn't teach the ion implantation of step (d) includes a plurality of partial ion implantation operations different in implantation energy from each other.

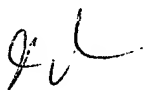
Claims 14-17 are allowed over prior art because applied prior art doesn't teach the step of performing chemical reaction acceleration for accelerating decomposition on said first resist pattern.

Claim 18 is allowed for the same reason as that of claim 6.

12. Wolf et al. (Silicon Processing for the VLSI, vol. 1, pages 181-182, 191-195, 407-408) is cited to show prior art.

13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to DuyVu n Deo whose telephone number is 703-305-0515.

DVD
March 19, 2003

A handwritten signature in black ink, appearing to be 'J. L.' or similar, located at the bottom center of the page.